Remarks

Applicants respectfully request that the Examiner reconsider the present application in light of the above amendments and following remarks. Claims 3-7, 10-13 and 16 have been amended and claims 1 and 8 have been cancelled without prejudice or disclaimer. No claims have been added. Therefore, claims 3-7 and 10-16 are pending in the present application.

Claim 3 has been rewritten in independent form to include all the limitations in cancelled claim 1, and to specify that the frusto-conical section is adjacent to a substantial portion of the first and second polepieces. *See Specification*, FIG. 2. Since claim 1 has been cancelled, claims 4 and 5 have been amended to change their dependency from claim 1 to claim 3. Claims 6 and 7 also have been amended to specify that the frusto-conical portion of the armature is adjacent to a substantial portion of the first and second polepieces. Claim 10 has been rewritten in independent form to include all the limitations in cancelled claim 8, and to specify that the frusto-conical section is adjacent to a substantial portion of the first and second polepieces. Since claim 8 has been cancelled, claims 11, 12 and 16 have been amended to change their dependency from claim 8 to claim 10. Claim 13 has been rewritten in independent form to include all the limitations of cancelled claim 1. Applicants respectfully request that the above amendments be entered.

Claims 1-4 have been rejected under 35 U.S.C. § 102(a) as being anticipated by U.S. Patent No. 6,313,726 to Golovatai-Schmidt et al. ("the Golovatai reference").

Claims 1 and 2 have been cancelled, therefore the rejection of these claims is moot. Applicants respectfully traverse the rejection of the remaining claims.

Amended claim 3 is directed to a solenoid for providing linear actuation. The solenoid includes first and second polepieces having axial bores coaxially disposed along a common axis, an electrical conductor wound about the polepieces in a plurality of turns, an armature, a bearing and a shaft. The armature is frusto-conical and movably disposed in the axial bores. The frusto-conical section Of the armature is adjacent to a substantial portion of the first and second polepieces. The bearing is axially retained in one of the first and second polepieces. The shaft is attached coaxially to the armature and extends through a supportive bore in the bearing wherein the bearing radially supports the shaft. The shaft is axially displaceable by electromagnetic displacement of the armature to provide the actuation. The armature is entirely separated from the axial bores of the polepieces by a generally cylindrical air gap, wherein the armature is prevented from contacting the polepieces.

None of the references of record teach or suggest a solenoid having an armature that is frusto-conical, wherein the frusto-conical section is adjacent to a substantial portion of the first and second polepieces as recited in amended claim 3. In rejecting claim 3, the Examiner used the armature (8) in the Golovatai reference to disclose the frusto-conical feature. However, as best seen in FIG. 1, the Golovatai reference includes a cylindrical armature (8) having a distal end that is

tapered inwardly. Applicants submit that tapering the end of the armature (8) does not make the armature (8) frusto-conical shaped. Moreover, as best seen in FIGS. 1 and 2 of the Golovatai reference, the tapered end of the armature (8) is only adjacent to one of the polepieces (19) during the operation of the solenoid, not a substantial portion of both polepieces (19, 20) as required by amended claim 3.

By providing a frusto-conical armature that is adjacent to a substantial portion of the first and second polepieces, numerous advantages are realized. For example, using a frusto-conical armature provides an absolute minimum thickness of air gap while positively precluding the armature from striking the polepieces. *See Specification*, pg. 5, lines 15-20.

For at least the forgoing reasons, Applicants respectfully request that the rejection of claim 3 be withdrawn. As claim 4 depends from claim 3, this claim is also not taught or suggested by the references of record for the same reasons set forth with respect to claim 3. Thus, Applicants request that the rejection of claim 4 also be withdrawn.

Claim 5 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Golovatai reference. As stated above, the Golovatai reference does not teach or suggest a solenoid having an armature that is frusto-conical, wherein the frusto-conical section is adjacent to a substantial portion of the first and second polepieces as recited in amended claim 3. As claim 5 depends from claim 3 and includes all of the limitations therein, claim 5 is not taught or suggested by the

references of record for at least the same reasons set forth with respect to claim 3. Thus, Applicants request that the rejection of claim 5 be withdrawn.

Claims 6-16 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Golovatai reference in view of U.S. Patent No. 5,947,092 to Hussey et al. ("the Hussey reference"). Claims 8 and 9 have been cancelled, therefore the rejection of these claims is moot. Applicants respectfully traverse the rejection to the remaining claims.

As with claim 3, claims 6, 7 and 10 include a solenoid actuator or solenoid having an armature that is frusto-conical, wherein the frusto-conical section is adjacent to a substantial portion of the first and second polepieces. Therefore, Applicants submit that claims 6, 7 and 10 are also not taught or suggested by the Golovatai reference for at least the same reasons set forth with respect to claim 3.

The Hussey reference fails to add anything to the Golovatai reference except to provide a space-efficient electromagnetic actuated exhaust gas recirculation valve for an engine. As in the Golovatai reference, the armature (110) used in the Hussey reference is cylindrical, not frusto-conical. Furthermore, the sleeve (112) used in the Hussey reference contributes to the thickness of the non-magnetic gap between the armature and the polepieces thereby limiting the maximum actuating force of the solenoid. *See Specification*, pg. 2, lines 8-13; FIG. 1. Therefore, the Hussey reference actually highlights the drawbacks and deficiencies of the prior art that the present invention intends to solve.

For at least the above reasons, Applicants request that the rejection of claims 6, 7 and 10 be withdrawn. Since claims 11, 12, 14, 15 and 16 depend from claims 6, 7 and 10, these claims are also allowable over the combination of the Golovatai and Hussey references for at least the same reasons discussed above with respect to claim 3.

Amended claim 13 is directed to a solenoid for providing linear actuation. The solenoid includes first and second polepieces having axial bores coaxially disposed along a common axis, an electrical conductor wound about the polepieces in a plurality of turns, an armature, a bearing and a shaft. The armature is movably disposed in the axial bores. The bearing is axially retained in one of the first and second polepieces. The shaft is attached coaxially to the armature and extends through a supportive bore in the bearing, wherein the bearing radially supports the shaft. The shaft is axially displaceable by electromagnetic displacement of the armature to provide the actuation. The armature is entirely separated from the axial bores of the polepieces by a generally cylindrical air gap, wherein the bearing has an axial length that is at least 1.5 times larger than the diameter of the shaft.

None of the references of record teach or suggest a solenoid including a bearing and shaft, wherein the bearing has an axial length that is at least 1.5 times larger than the diameter of the shaft as recited in claim 13. In order to establish a prima facie case of obviousness, the Examiner must provide specific reasons for the determination that the claimed subject matter is suggested by the references of

record. *See Ex parte Humpherys*, 24 USPQ.2d 1255 (B.P.A.I. 1992). However, the Examiner has failed to point out any specific features in the Golovatai and Hussey references that disclose or suggest a bearing having an axial length that is 1.5 times larger than the diameter of the shaft. Thus, a prima facie case of obviousness has not been established, and Applicants request that the rejection of claim 13 be withdrawn.

Even if an explanation of the rejection of claim 13 was provided, Applicants submit that the combination of the Golovatai and Hussey references fail to suggest a bearing having an axial length that is at least 1.5 times larger than the diameter of a shaft. In the Final Office Action, the linear ball cage (12) in the Golovatai reference was used to teach the bearing set forth in claim 13. *See Final Office Action*, ¶¶ 2, 5. However, as best seen in FIG. 2 of the Golovatai reference, the ball (18) functions as the bearing between the polepiece (19) and the shaft (10), not the linear ball cage (12). The linear ball cage (12) merely operates to hold the ball (18) in position. As such, in evaluating claim 13, the axial length of the ball (18) in the Golovatai reference should be compared with the diameter of the shaft (10). A review of FIG. 2 shows that the axial length of the ball (18) is not 1.5 times greater than the diameter of the shaft (10). Providing a solenoid having a bearing with an axial length that is at least 1.5 times larger than the diameter of a solenoid shaft minimizes the wobble of the shaft in the bearing and cocking of the armature within the polepieces.

See Specification, pg. 5, lines 13-15. For this additional reason, Applicants request that the rejection of claim 10 be withdrawn.

Dependant claims 14-16 also include a limitation directed to a bearing that has an axial length that is at least 1.5 times larger than the diameter of the shaft. Thus, for the same reasons set forth above with respect to claim 13, Applicants submit that claims 14-16 are further distinguishable over the references of record.

Conclusion

Accordingly, Applicants submit that claims 3-7 and 10-16 are in condition for allowance and such allowance is respectfully requested. Should the Examiner feel that any unresolved issues remain in this case, the undersigned may be contacted at the telephone number listed below to arrange for an issue resolving conference.

The Commissioner is hereby authorized to charge the $86.00 required by 37 C.F.R. § 1.16(b) for the additional independent claim in excess of three, and any other fees that may have been overlooked, to Deposit Account No. 10-0223.

Respectfully submitted,

7/7/04
Date

Dennis B. Danella
Reg. No. 46,653

JAECKLE FLEISCHMANN & MUGEL, LLP
39 State Street
Suite 200
Rochester, New York 14614-1310
Telephone: (585) 262-3640
Facsimile: (585) 262-4133